

**PRODUCT DISASSEMBLY PLANNING USING DESIGN FOR
DISASSEMBLY AND GENETIC ALGORITHM**

A thesis submitted to the Graduate School in partial fulfilment of the requirements
for the degree Master of Science (Intelligent System)

Universiti Utara Malaysia

By

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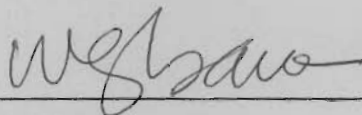
**PRODUCT DISASSEMBLY PLANNING USING DESIGN
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ABSTRAK

Kajian ini memperkenalkan kegunaan teknik Artificial Intelligence (AI) iaitu Algoritma Genetik (GA) untuk mengatasi permasalahan melibatkan turutan nyah-pemasangan product. Generasi turutan nyah-pemasangan dihasilkan berpandukan methodology Rekabentuk untuk Pemasangan (DFA). Dalam projek ini, prestasi Rekabentuk untuk Nyah-Pemasangan (DFD) dan Algoritma Genetik dalam memilih turutan nyah-pemasangan yang optimum diuji. Permasalahan kajian melibatkan pencarian masa nyah-pemasangan yang optimum, iaitu merujuk kepada masa yang paling minimum. Objektif kajian ini adalah mencari turutan yang optimum dengan masa nyah-pemasangan yang terpendek. Kajian ini dimulakan dengan nyah-pemasangan secara manual yang mengguna teknik DFD. Pemegangan manual dan pemasukan manual akan dijadikan sebagai panduan dalam mengira masa proses nyah-pemasangan. Akhirnya, teknik Genetik Algoritma akan diguna dalam proses tersebut. Hasil keputusan daripada teknik, Rekabentuk untuk Nyah-Pemasangan (DFD) dan Algoritma Genetik dibandingkan untuk menunjukkan prestasi teknik Algoritma Genetik yang dicadangkan.

ABSTRACT

This paper introduces the use of an Artificial-Intelligence (AI) based technique, Genetic Algorithm (GA), to solve single model product disassembly sequence problems. The generation of disassembly sequence is modeled using Design for Assembly (DfA) working principles. In this paper, the performances of Design for Disassembly (DfD) and GA in selecting optimum disassembly sequence were tested. The problem involves minimizing the total disassembly time by proper feeder allocation and component sequencing. The objective is to find out the optimum disassembly sequence with minimum disassembly time. The study started by manual disassembly using DfD which involves manual handling and manual insertion guideline in estimating time to search for optimum sequence. Finally, GA technique is applied to search for the optimum sequence. The results were compared between DfD and GA to show the efficiency of the proposed GA approach.

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Praise and glory to the Father in heaven who had interceded my prayer, guide me and gave me the courage to complete my master programme.

This project is study about disassembly process which in the engineering field that merely strange to me. I had to study how far does AI techniques would helped in such process. Mr. Ruslizam Daud, my supervisor in this project, had guided me all the way long. I would like to express my appreciation to him for his creativity encouraging guidance.

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LIST OF ABBREVIATIONS

AI	Artificial Intelligent
GA	Genetic Algorithm
DFD	Design for Disassembly
DFA	Design for Assembly

CHAPTER 1

INTRODUCTION

This chapter briefly explains the background of the study that mainly involves the disassembly process, Genetic Algorithm as AI technique to select the optimum disassembly sequence. The problem statement, objectives, significance of the study and scopes will also be introduced.

1.1 Research Background

Environmental issues are becoming increasingly important to product manufacturers as well as to municipal and governmental authorities. This trend is most apparent when the environmental impact of worn-out products is considered. The shortage of landfill and waste burning facilities constantly remind us that our products do not simply disappear after disposal.

Increasing concern regarding the environmental effects associated with a product's life cycle has propelled the end-of-life (EOL) disassembly to prominence (Viswanathan S. et al. 2004). Disassembly is an important process affecting the product retirement. Once disassemble, the engineer or production department know which part of a product can be reuse, recycled, stored or dispose. Reuse option includes the repair, refurbish and cleaning processes. Recycling is performed in order to regain the material content of the EOL product. Storing the

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